

WHAT IS CLAIMED IS:

- 1 1. An integrated circuit fabrication process, the process comprising
2 the steps of:
3 patterning a transistor gate pattern on a photoresist layer;
4 curing the transistor gate pattern with an electron beam;
5 trimming the cured transistor gate pattern; and
6 transferring the trimmed transistor gate pattern to a layer
7 disposed below the photoresist layer to form a transistor gate, wherein the
8 transistor gate includes a width and a length, and a variation of the width
9 along the length of the transistor gate is reduced due to the curing step.
- 1 2. The process of claim 1, wherein the photoresist layer is
2 comprised of a photoresist material typically used for at least one of 248 nm
3 lithography, 193 nm lithography, and extreme ultraviolet light (EUV)
4 lithography.
- 1 3. The process of claim 2, wherein the photoresist layer is comprised
2 of a photoresist material of a type typically used for 193 nm and 248 nm
3 lithography and is commercially available.
- 1 4. The process of claim 1, wherein the final gate transistor width is
2 in the range of approximately 20-60 nm.
- 1 5. The process of claim 1, wherein the curing step includes exposing
2 the transistor gate pattern to the electron beam having a dose in the range of
3 approximately 100-100000 $\mu\text{C}/\text{cm}^2$.
- 1 6. The process of claim 1, wherein the curing step includes exposing
2 the transistor gate pattern to the electron beam having an accelerating voltage
3 in the range of approximately 0.5-20 Kv.

1 7. The process of claim 1, wherein the curing step includes changing
2 at least one of a vertical etch rate, a horizontal etch rate, and a minimum
3 extension erosion rate associated with the transistor gate pattern.

1 8. A method of forming a transistor having a gate width of less than 70
2 nm, the method comprising the steps of:

3 E-beam radiating a gate pattern of a photoresist layer;
4 trimming the E-beam eradiated gate pattern of the photoresist
5 layer; and

6 etching a polysilicon layer disposed below the photoresist layer
7 in accordance with the trimmed gate pattern to form a gate of the transistor,
8 the gate width being less than 70 nm.

1 9. The method of claim 8, wherein the E-beam radiating step uses an
2 electron beam at a dose in the range of approximately 100-100000 $\mu\text{C}/\text{cm}^2$.

1 10. The method of claim 9, wherein the electron beam is provided at
2 an accelerating voltage in the range of approximately 0.5-50 Kv.

1 11. The method of claim 9, wherein a uniformity of the gate width is
2 4 to 6 nm over 3 nm segment.

1 12. The method of claim 9, wherein the photoresist layer is comprised
2 of a material selected from a group including acrylate-based polymer,
3 alicyclic-based polymer, and phenolic-based or polystyrene-based polymer.

1 13. The method of claim 9, wherein the E-beam radiation step includes
2 affecting at least one of a vertical etch rate, a horizontal etch rate, and a
3 minimum extension erosion rate associated with the gate pattern of the
4 photoresist layer.

1 14. The method of claim 9, wherein the E-beam radiation step
2 achieves an enhancement interim rate for a commercially available resists

3 using lithography processes with either 248 nm and 193 nm wavelength of
4 light.

1 15. An integrated circuit, comprising:
2 an isolation region;
3 a transistor surrounded by the isolation region, wherein the
4 transistor includes a gate, a critical dimension of the gate being less than
5 approximately 60 nm, and the gate being defined by an E-beam irradiated
6 gate feature on a photoresist layer.

1 16. The integrated circuit of claim 15, wherein the E-beam irradiated
2 gate feature on the photoresist layer is formed by an electron beam exposure.

1 17. The integrated circuit of claim 15, wherein a uniformity of the critical
2 dimension along a length of the gate is 4 to 6 nm over a 3 nm segment.

1 18. The integrated circuit of claim 15, wherein the photoresist layer
2 is comprised of a material selected from acrylate-based polymer, alicyclic-
3 based polymer, and polystyrene and phenolic-based polymer.

1 19. The integrated circuit of claim 18 wherein the critical dimension
2 is between 20 and 60 nm.

1 20. The integrated circuit of claim 18 wherein uniformity of the
2 critical dimension along a length of the gate is 4 to 6 more a 3 nm segment.